

PATENT SPECIFICATION

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- (21) Application No. 44250/75 (22) Filed 28 Oct. 1975
 (31) Convention Application No. 2457008 (32) Filed 3 Dec. 1974 in
 (33) Fed. Rep. of Germany (DE)
 (44) Complete Specification Published 26 Jul. 1978
 (51) INT. CL.² B60T 8/18
 (52) Index at Acceptance
 F2F 284 292 300 304 310 318 452

(19)



(54) AUTOMATIC LOAD DEPENDENT BRAKING FORCE CONTROL LINES

(71) We, WABCO WESTINGHOUSE GmbH, a German Company of 3000 Hannover 91, Postfach 91 1280, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to automatic load dependent braking force control means and to a compressed air braking system for air-suspension fitted vehicles provided with such braking force control means.

Automatic load dependent braking force control means are known for matching the braking pressure in the brake cylinders of a vehicle to the instant loading condition of the vehicle. This matching occurs automatically by virtue of the pressure in air suspension bellows of the vehicle, which pressure is a function of the axle loading, setting the amount of braking pressure reduction or braking pressure increase provided by the control means. The various values applicable to each vehicle type can be set externally.

In most cases only the braking force on the rear axle is controlled, for which the control pressure required for the operation of the braking force control means is normally derived from one of the two rear axle suspension bellows.

It is also known practice to obtain the control pressure from two bellows and to supply the momentarily highest pressure through a two-way valve to the control piston of the control means.

Under normal circumstances, devices embodying such control means for the automatic regulation of the braking force for air suspension vehicles have proved successful. It is however possible — depending on the application conditions of the vehicles — for cases to arise in which the pressure levels in the two (rear axle) air suspension bellows differ to such an extent that the vehicle, depending from

which suspension bellows the braking force control means is operated, is either braked excessively or too little.

To give a better understanding of this possibility, two actual examples in respect of which the above statements apply are described in the following:

1. A vehicle is loaded on one side. The air suspension bellows on the heavier loaded vehicle side is subject to a higher pressure than the bellows on the other side. If now, on brake application, the control pressure for the braking force controller is derived from the suspension bellows subject to the higher pressure, the braking action on this side is equivalent to normal conditions. The identical braking action, which is however forced upon the opposite wheel and which is excessive because of the lighter axial loading on this side, may lock the wheel as the result of the low friction resistance. If, on the other hand, the control pressure is derived from the suspension bellows subject to the lower pressure, the resultant braking action is inadequate for the vehicle side subject to the heavier loading.

2. A vehicle brake is applied as the vehicle travels along a curved path (e.g. turning a corner or negotiating a bend in the road). The vehicle weight of the braked vehicle is displaced due to centrifugal force to the radially outer side of the curved path. This may have the same consequences as described above under 1.

The problems of the above drawbacks might be solved by inserting between the control valve of the control means and the two air suspension bellows, a special supplementary valve which produces a mean pressure from the pressures of the two air suspension bellows. This mean pressure is then employed for the control. Such a solution can be relatively expensive and, because of the tolerances and hysteresis of the so-called mean pressure valve may produce substantial inaccuracies in operation.

It is therefore desirable to provide simpler and functionally more accurate equipment.

According to this invention, there is provided automatic load-dependent brake force control means for a fluid pressure operable air brake system including a fluid pressure modifying valve having adjustment means responsive in operation to applied control pressure representing vehicle loading to modify an output braking pressure according to said loading and said adjustment means having a dual piston arrangement responsive to control pressures at two input ports connected in use to spaced vehicle suspension units to effect adjustment in accordance with the mean of said control pressures.

By way of example, one embodiment of this invention will now be described with reference to the accompanying drawing which is a schematic diagram of a controller according to this invention and comprising interconnected pressure pistons.

As illustrated, the controller comprises a casing 1 in which is disposed a diaphragm control piston 2; above this is a chamber 3, which connects with atmosphere through a hole 4. Below the control piston 2 is a chamber 5 which is connected through a port 6 with the vehicle driver's brake valve 7. A valve member 8 blocks, in the setting shown, an inlet valve seat 10 connecting the chamber 5 with a chamber 9.

Chamber 9 is provided with a port 12 connected to the vehicle brake cylinders 11. The control piston 2 is attached to a piston rod 13 passing through the valve member 8 in a sealing manner and reaching into a blind hole 14 in a piston 15.

To the bottom end of the piston rod 13 is attached a fork 16 to the lower end of which is linked, by means of a pin 17, a lever 18 which can also swivel round a pin 19 fixed in the casing 1. The lever 18 in association with a support member 20 located above it and consisting of a roller, and with a lever 21, which swivels round a pin 22 fixed in the casing 1, forms a transmission system for the forces arising on the control piston 2 and the piston 15.

The piston 15 abuts with its lower end against the upper side of the lever 21, whilst its upper end provides an outlet valve seat 23, which in the setting shown is in contact with the valve member 8. An annular chamber 24 above the piston 15 is connected through a hole 25 with the chamber 9. A chamber 26 below the piston 15 is connected at all times with atmosphere through a venting screen 27. A compression spring 28 reacts between the piston 15 and the piston rod 13 of the control piston 2.

The support member 20 is guided in a locating device 29 with a guide extension 30. Against the locating device 29 abuts a piston rod 31 of a tandem piston arrangement 32 having larger and smaller pistons 40 and 42 in slidable within cylinders 33 and 34 respectively. A pressure medium, subject to the load variable

pressures from one air pressure unit comprising suspension bellows 37 acts on respectively the inner annular surface of the interconnected pistons 40 and 42 and pressure from another air pressure unit comprising bellows 38 acts upon the left hand surface 41 of the smaller piston 42. The guide extension 30 has a stop 43 and projects displaceably into a casing extension 44. Within the guide extension 30 is disposed an adjustable setting spring 46 acting between the holding device 29 and a closure cap 45.

On brake application, the compressed air supplied to the chamber 5 from the brake valve 7 passes through the open inlet valve seat 10 into the chamber 9 and then onwards into the brake cylinder 11 connected to it. Simultaneously, this compressed air raises the diaphragm piston 2, which transmits its motion via the piston rod 13 with the attached form 16 and the lever 18 linked to it by the pin 17 to the support member 20 and the lever 21. Compressed air also penetrates through the hole 25 into the annular chamber 24 above the piston 15 and presses the latter against the lever 21.

It depends on the position of the support member 20, which is determined by the air suspension bellows pressure controlled motion of the control piston 32 through the ports 37 and 38, as to when the pressure on the piston 15 is sufficient to overcome the counter force from the lever 18 controlled by the piston 2. As soon as this is the case, the piston 15 is displaced downwards. The following valve member 8 blocks the inlet 10 and the final braking setting shown in the drawing is obtained.

On partial release of the braking, the now greater pressure from the brake cylinders 11 opens a non-return valve between the chambers 9 and 5 (not shown) so that excess pressure escapes through the chamber from the braking equipment connected to it. The piston 2 is correspondingly relieved in the event of there being no longer any braking pressure in the chamber 5. Its force acting against the downwards pressure from piston 15 is lost, as a result of which the piston 15 continues its downwards travel under the influence of the pressure still available in the chamber 24. This causes the opening of the outlet 23 and venting of the brake cylinders axially of and through a hole (not shown) in the piston 15 and through the vent 27. Since the pressure in the chamber 24 is thus lost, the spring-loaded piston 15 is again displaced upwards to raise the valve member 8 and thereby open the inlet valve seat 10.

The brake force controller has thus returned to its original released setting.

The inner part of cylinder 33 is connected through the port 35 as seen from the foregoing and the line 47 with the suspension bellows 37, and the left hand part of cylinder 34 is connected through the port 36 and the line 48 with the suspension bellows 38. As a function

of the level of loading (see Examples 1 and 2 in the introduction to this specification and preceding the present description of the exemplary embodiment) different pressure levels are transmitted into the annular chamber 33 and the chamber 34.

The amount by which the annular area of piston surface 39 of piston 40 exceeds the annular area of piston 42 which faces it equals the effective area 41 on the left of piston 42. The sum of the forces resulting from the area loadings on these surfaces therefore yields a value proportional to the mean pressure to which the differential piston member is effectively subjected and which is a function of the actual axial loading even when there exists a difference between the left and right-hand vehicle sides due to unequal side loadings or travel along a curved path.

WHAT WE CLAIM IS:-

1. Automatic load-dependent brake force control means for a fluid pressure operable air brake system including a fluid pressure modifying valve having adjustment means responsive in operation to applied control pressure representing vehicle loading to modify an output braking pressure according to said loading and said adjustment means having a dual piston arrangement responsive to control pressures at two input ports connected in use to spaced vehicle suspension units to effect adjustment in accordance with the mean of said control pressures.

2. Control means according to Claim 1, wherein the dual piston arrangement has two connected pistons of respectively larger and smaller diameter and slidable in respectively larger and smaller interconnected cylinders, and wherein the effective surface areas of the smaller piston subject to the pressure at one port equals the difference of effective areas of

both pistons subject to pressures at the other port so that the sum of the forces thereon resulting from the fluid pressures thereon provides a desired control force.

3. Control means according to Claim 1 or Claim 2, wherein the said arrangement is housed in a casing that also houses the modifying valve means for controlling the flow of compressed air to brake cylinders of the vehicle upon brake actuation.

4. Automatic load dependent braking force control means constituting an automatic load-variable braking controller and substantially as herein described with reference to the accompanying drawing.

5. A compressed air braking system for a vehicle having a fluid suspension system, the braking system comprising automatic load dependent braking force control means according to any preceding claim.

6. A vehicle having a compressed air braking system according to Claim 5 and a fluid suspension system, the said two control ports of the control means being connected respectively to a variable volume fluid container of said fluid suspension system on each side of the vehicle.

7. A vehicle according to Claim 6, wherein said containers are associated with the rear wheels of the vehicle.

8. A vehicle according to Claim 6 or Claim 7, wherein said variable volume containers are of bellows-like form.

9. A vehicle according to any one of Claims 6 to 8, wherein the fluid suspension system is a gas suspension system.

10. A vehicle according to Claim 9, wherein the gas is air.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

